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Regression CNN Based Energy and Vertex Reconstruction at DUNE

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DUNE is the next-generation flagship neutrino experiment designed to decisively measure neutrino CP violation and mass hierarchy. DUNE far detectors are based on liquid argon time projection chamber (LArTPC) technology, which offers an excellent spatial resolution, high neutrino detection efficiency, and superb background rejection. Reconstruction of neutrino events in DUNE's high-resolution detectors is challenging. It is complicated by missing energy due to argon impurity, nonlinear detector energy responses, invisible energy, hadron identities (mass), and overlaps between lepton and hadron interactions. To address these issues, neutrino events can be reconstructed directly from pixel map images of interactions in DUNE's detectors with deep learning methods - in particular, Convolutional Neural Networks (CNNs). In this talk, we will focus on recently developed regression CNNs to reconstruct neutrino energy and interaction vertices. Compared with traditional reconstruction, these methods show a significantly better performance in Monte Carlo simulation.

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